

Docket No. 3411-4
Application No. 09/551,867
Page 18 of 29

REMARKS

Applicants respectfully request reconsideration and withdrawal of the rejection of the claims. Prior to the present response, claims 1-37 were pending. By way of the above amendments, claims 1, 2, 4, 19, 21, 29, 30 and 37 are amended. Accordingly, claims 1-37 currently are pending.

Before proceeding with an analysis of the rejections, it is to be noted that while the "Office Action Summary" (i.e., page 1 of the Office Action) indicates claims 31 and 32 are rejected, the Action contains no grounds of rejection with respect to these claims. Absent any grounds for rejection, Applicant respectfully submits that claims 31 and 32 are allowable.

On pages 2-5 of the Office Action, claims 1, 4, 19, 21, 23, 29, 30 and 37 are rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite. This rejection is respectfully traversed.

With respect to claim 1, the Examiner asserts that the recited "estimated observation quantity" is "unclear for what the non-linear characteristic reproducing unit performs." While Applicant disagrees that claim 1 is indefinite, especially when read in light of the specification, this claim has been amended to further clarify that the non-linear characteristic reproducing unit operates to determine a transformation parameter to transform the first state quantity to the second state quantity. Support for this change can be found, for example, on page 72, line 1 to page 73, line 12, and in Figure 12. Further examples showing this feature can be found, for instance, in each model view, such as Figure 1, Figure 4, Figure 15, Figure 17, Figure 21 and Figure 26. It is respectfully requested that this rejection be withdrawn.

Regarding claim 4, the Examiner asserts the recited features of "the non-linear characteristic reproducing unit the estimation value" and "divided or differentiated with an absolute value" are unclear. It is respectfully submitted that the meaning of these features would have been clear to one of ordinary skill in the art when reading these claims in light of the specification. However, to improve readability and to conform this claim with the changes made to claim 1, Applicants have amended claim 4. Support for the amendment can be found, for example, at page 45, line 17 to page 48, line 7, and in Figure 2 and equations 3 and 5. It is respectfully submitted that claim 4 fully complies with Section 112, second paragraph.

Next, the Examiner alleges that in claim 19, the recited "a logical value," "sampling time," and "discrete values" in the logical decision unit are unclear in what they relate to.

W661616.1

Docket No. 3411-4
Application No. 09/551,867
Page 19 of 29

The Examiner also believes the feature of "a relation between the input state quantity and the output state quantity is changed over to a relation according to the logical value at the subsequent sampling time" is unclear with respect to "how a relation changed over to a relation according to the logical value." In response, claim 19 has been amended.

With reference to the description of the exemplary basic execution means of the logical decision unit for obtaining the logical value, at page 14, line 12 to page 16, line 12, and the example described at page 130, line 15 to page 131, line 25, and Figure 46, the disclosed non-linear characteristic reproducing apparatus example is provided with a logical decision unit selecting the logical value of a plurality of discrete values based on one or more variables inputted from at least one state quantity of the linear model unit, and a state quantity selecting unit operates to select the first state quantity and the second state quantity in accordance with the selected logical value. Claim 19 has been amended clarify these features. It is respectfully submitted that amended claim 19 is definite.

In connection with claim 21, the Examiner alleges that the recitation "selecting unit integrates the input state quantity" is unclear. As pointed out above, however, claims are to be read, not in a vacuum, but in light of the specification. For example, page 15, line 12 to page 16, line 12 discloses the fundamental concept, and page 132, line 2 to page 133, line 16 and Figure 48a disclose an example in which, on the basis of a value of an integrator for converting "vd" in Figure 48a to "y," rigidity K_R is made connection/release while operating a switch S_{wk} of the state quantity selecting unit in accordance with the logical value (0, 1) of the logical decision unit represented by hexagon. To clarify such feature in claim 21, the claim has been amended to recite that "in a case where the logical value at the subsequent sampling time determined by said logical decision unit into which the output state quantity is inputted is a predetermined logical value, said state quantity selecting unit outputs an output state quantity which is changed over to an initial value at the subsequent sampling time." It is respectfully submitted that amended claim 21 is definite, and thus fully complies with Section 112, second paragraph.

With respect to claim 23, the Examiner asserts that the recited "estimation observation quantity" is unclear for what the logical function does. The Examiner also required that a specific function for the logical decision unit be recited. As mentioned above, however, it is axiomatic that claims are to be read in light of the specification, not in a vacuum. Furthermore, the Examiner here appears to be improperly equating the breadth of the recited

W661616.1

Docket No. 3411-4
Application No. 09/551,867
Page 20 of 29

features with indefiniteness. This is further evident in the Examiner's statements, "The cited feature "impossible state" in the claim made the claim unclear for what it claims for. What is the impossible state? Does it relate to an uncontrollable state? Why impossible state need for control." (See, page 4, lines 3-6.) The Examiner's attention is respectfully directed to page 132, line 2 to page 133, line 16, Figures 47 and 48, and page 108, line 1 to page 114, line 14 and Figure 33, which describes an example in which a relative movement possible state is a state where two members move with connected state, while a relative movement impossible state is a state where two members move independent of each other.

In response to the Examiner's question "why impossible state need for control," in the preset invention, the relative movement possible state and the relative movement impossible state are reproduced equally because to reproduce the dynamic behavior of parts or the like (e.g., see page 171, line 4 to page 172, line 12).

With respect to the Examiner's statements concerning the specific function for the logical decision unit, in the exemplary example mentioned above, in order to reproduce behavior of the relative movement possible state and the relative movement impossible state of the above described exemplary two members, the logical decision unit decides connection state (i.e., relative movement possible state) and disconnection state (i.e., relative movement impossible state) while estimating both positions, from the integrated value of relative speed between two members (e.g., see page 132, line 2 to page 133, line 16 and Figures 47 and 48), or integrated value of an angular velocity of a principal part (e.g., see Figure 33), for example. The application also describes an exemplary function of a logical decision unit (e.g., see page 132, line 2 to page 133, line 16 and Figures 47 and 48).

With regard to the unclear points asserted in the Office Action concerning claim 29: "predetermined first state quantity," claim 29 has been amended to clarify this feature while adding "the first observation state quantity imputed to a state quantity transformation unit to lines 1-11 of this claim. In response to the Examiners assertion regarding the recitations "slow change state quantity" and "behavior change," claim 29 has been amended to clarify these features and recite "temperature increase or the like. Support for these amendments can be found, for example, in the application at page 20, line 25 to page 23, line 24, which describes general concepts, and in the example described at page 173, line 22 to page 178, line 6 and Figures 69, 70, and at page 181, line 9, to page 188, line 18 and Figures 72, 75 and 76, for instance. It is respectfully submitted that amended claim 29 is definite.

W661616.1

Docket No. 3411-4
Application No. 09/551,867
Page 21 of 29

With respect to claim 30, the Examiner asserts that the recited feature, "the estimated observation value," makes the functional unit in the claim unclear. While it is believed that one of ordinary skill in the art would understand this feature, especially in light of the specification, Applicant has amended claim 30 to make it abundantly clear that the stationary value is generated in accordance with the observation quantity or the estimated observation value of the second observation state quantity. Support for this amendment is found, for example, at page 173, line 22 to page 178, line 6, in Figures 69 and 70, at page 181, line 9 to page 188, line 18, and in Figures 72, 75 and 76.

Finally, the Examiner objected to the recitations, "an estimated observation quantity," "a predetermined first observation state quantity" and "the received estimated observation quantity" in the non-linear model for allegedly making the claim unclear. Again, while Applicant disagrees that these features render the claim indefinite, especially when read in light of the specification, the claim has been changed to improve readability and to broaden it in some respects. More specifically, claim 37 has been amended to add "observation" to "state quantity" and to eliminate "predetermined" in the recitation regarding a first observation state quantity from the linear model unit.

For the foregoing reasons, it is believed all pending claims fully comply with with Section 112, second paragraph. As such, this rejection should be withdrawn.

Starting on page 5, the Action includes a rejection of claims 1-28 and 33-36 under 35 U.S.C. §103, as allegedly being unpatentable over Samad (U.S. Patent No. 5,847,952). The rejection is respectfully traversed.

The present invention realizes an apparatus for truly reproducing dynamic behavior of products or components including non-linear characteristics. In contrast, the object of the Samad patent is to realize an apparatus for freely controlling dynamic behavior of products or components including non-linear characteristics while utilizing neural network.

The Samad patent necessitates the products or the components to become controlled objects. Samad causes the products or the components to move in such a way that the state quantity and the characteristic parameter of the products or the components are inputted to the control unit from the outside to output processed result thereof. On the other hand, nothing exist other than physical characteristics (angular velocity of rotational axis, torque or the like) transferred between the products/components in the reproducing apparatus of the present invention. Therefore, the present invention necessitates that a parameter for the

W561616.1

Docket No. 3411-4
Application No. 09/551,867
Page 22 of 29

connection transformation unit is made to generate while utilizing the connection transformation unit between input/output (physical characteristics) and the input/output unit followed by incorporating it to the connection transformation unit again.

The tuner of Samad is different from the present invention in that Samad performs sequential processing of an outside input, a pretreatment unit, a non-linear approximation apparatus, and an after-treatment unit and outside output, whereas the present invention has closed loop type constitution in which a parameter obtained in such a way as to input a part of the input/output of the state quantity transformation unit to the non-linear characteristic reproducing apparatus is set again to the state quantity transformation unit. This is clear, for example, from the differences between claim 1 of the present invention and claim 1 of Samad.

Further, in connection with the Examiner's reasons of obviousness due to dynamical processes of Samad, there will be described in the following that the present invention is realized with mechanisms achieved by improving conventional mechanical (dynamical) processing.

1. Independent Claim 1

The present invention inputs the input of the state quantity transformation unit to the non-linear characteristic reproducing apparatus. The output of the non-linear characteristic reproducing apparatus is inputted again to the state quantity transformation unit. That is, the present invention is a closed loop system. The constitution for faithfully reproducing reality such as components is realized. The reference Samad is a sequentially feeding system in that the reference Samad performs sequential processing of an outside input, a pretreatment unit, a non-linear approximation apparatus, an after-treatment unit and outside output, reference Samad has constitution to realize an apparatus for freely controlling dynamic behavior of products or components. Differences therebetween are clear with a comparison of claim 1 of the present invention to claim 1 of Samad.

Further with respect to differences between the two, refer to page 72, line 1 to page 73, line 12 and Fig. 12, and as the example, refer to Figures 1, 4, 15, 17, 21, 26 or the like of the present invention, which illustrate difference with model views. By contrast, Samad patent's description of the control system with the non-linear approximation apparatus of Figures 2, 7, and 11, it is stipulated that the process characteristic parameter and the closed

W661616.1

Docket No. 3411-4
Application No. 09/551,867
Page 23 of 29

loop performance parameter are inputted individually.

Moreover, in connection with the comment in the last paragraph of the reason of rejection under the 35 U.S.C. §103, "it would have been obvious for those skilled in the art at the time the invention..." , detailed comments are provided about difference between the conventional mechanical (dynamical) processing and the present invention.

2. Dependent Claim 2

In addition to reciting all the patentable features of claim 1, claim 2 sets forth further points of distinction. The reference Samad (column 12, line 45 to column 13, line 58 and Fig. 17) is one in which, as clear from Figs. 13 and 17, the characteristic value in the non-linear approximation apparatus is made to adjust with the output of the optimization algorithm. Input/output relationship between the input parameters (PJ (27), PP (27)) of the non-linear approximation apparatus and another pretreatment means and after-treatment means is a sequentially feeding system described in the arguments relative to the reason of rejection under the U.S.C. §103 for claim 1. Consequently, the Samad system is clearly different from the closed loop system of the present invention that is also described in the arguments relative to the reason of rejection under the U.S.C. § 103 for claim 1. Further, as the input of the non-linear approximation apparatus, the process parameter PP (27) of the controlled object (page 6, line 3 from the bottom) and the performance parameter PJ (27) of closed loop for adjusting the control system response characteristic (page 6, line 2 from the bottom, and page 7, line 7 from the top, specific example; page 6, line 10 from the top) are clearly described.

3. Dependent Claim 3

Claim 3 depends from claim 1. Hence, claim 3 is patentable at least for the above reasons, and furthermore, for the additional features recited.

For example, the Samad patent does not disclose normalization technique to be common belief of the normalization disclosed in the present invention (e.g., see Samad's claim 7, 1st paragraph:...for transforming a set of input parameters at the input into a set of normalized parameters at the output, and 2nd paragraph: "for algorithmically operating on the set of normalized parameters") and (the example in 10 page: "process gain I_c is normalized into 1.0").

W661616.1

Docket No. 3411-4
Application No. 09/551,867
Page 24 of 29

4. Dependent Claim 4

Claim 4 is not a method for estimating a state space as implied in the Office Action, but a technique to incorporate the prior art into the nonlinear characteristic reproducing apparatus of the present invention. Description concerning the state space is not provided in the cited reference.

5. Dependent Claims 5 to 14

Claims 5 to 14 depend either directly or indirectly from claim 1, and are therefore patentable for the above reasons given with respect to claim 1. Additionally, these dependent claims define combinations reciting additional features not taught or suggested in the Samad patent:

The reason for rejection of claims 5 to 14 is one in which conventional mechanics (engineering) is taken to as assumption. The present invention claims the means for incorporating improved point, which is not clarified by the conventional mechanics (engineering); and the incorporating means incorporates the improved point into the non-linear characteristic reproducing apparatus. Claims 5 to 14 claim the incorporating mechanisms for incorporating the improved points to the non-linear characteristic reproducing apparatus. In the following, differences are pointed out between the conventional mechanical processing and that of the present invention.

(i) Point in connection with spring characteristics

In the conventional mechanics, Hook's law (force = spring constant x displacement) is established as the theory of the spring. However, this law is difficult to apply to a non-linear spring in which spring characteristic varies depending on displacement. Claim 5 of the present invention resolves non-linear problem of the spring while disclosing a method for obtaining a spring force upon integrating variation of the force, before obtaining variation of the force from the velocity (see Figure 13 and page 73, line 16 to page 78, line 5: internal state quantity X' of equation 13 indicates variation of the force, and X indicates the force; page 78, line 7 to page 86, line 26 and Figure 17: internal state quantity X_c' of equation 20 indicates variation of the pressure, and X_c indicates the pressure).

W661616.1

Docket No. 3411-4
Application No. 09/551,867
Page 25 of 29

(ii) Point in connection with governing equation

The dynamic equation used in the conventional mechanics is formulated with balance of force in which displacement, velocity and acceleration are taken to as independent variables; and force is taken to as dependent variable. For this reason, it is necessary that calculation is performed repeatedly in every sampling time, so that the displacement and the velocity are made to converge within the range of predetermined tolerance. The present invention adds the conventional dynamic equation to a balance equation of the velocity (angular velocity) in which the force (variation of the force) is taken to as independent variable and the velocity is taken to as dependent variable, and mixes the both with each other to balance relationship between the force and the velocity. By this combination, the force and the velocity are balanced with each other, therefore, calculations repeated in every sampling time become unnecessary, high speed calculation becomes possible, and it is possible to avoid un-stability of the calculation caused by negative resistance or the like. (See, page 73, line 16 to page 78, line 5 and Figure 17, the first line of equation 20 is the force, and the second line is balance equation of the velocity and $xm' xk' xm, xk$ balance relationship between the velocity and the force. Also see, page 101, line 21 to page 102, line 16 and Figure 29, the first line of equations 39 and 41 is the force, and the second line is balance equation of the velocity. Like equation 20, the velocity and the force are balanced with each other.)

(iii) Point in connection with Equivalent Transformation of Rank difference (velocity) /Flowage quantity (force)

In the conventional mechanics, it is not possible to find means for non-linear connecting the force and the velocity between a plurality of components by only one parameter characteristic. The present invention shows, as the means to realize this, a coefficient parameter changing distribution of the velocity and the force without adding alteration to the product (instantaneous energy) of the force and the velocity, and a means for realizing non-linearization thereof. (See, page 86, line 27 to page 91, line 14, it is indicated by the non-linear transfer constant Φ_a of Figure 21, the non-linear transfer constant Φ_b of Figure 22 and equation 31, and the transfer constant ϕ of page 108, line 1 to page 114, line 14, Figure 33, and equation 45. The product of the velocity and the force of right side of the transfer constant of the both drawings is equivalent to the product of the velocity and the

W661616.1

Docket No. 3411-4
Application No. 09/551,867
Page 26 of 29

force of left side, so that the instantaneous energy becomes the same.)

In claim 6 of the present invention, variation of the pressure is obtained from a deformation velocity.

With respect to dependent Claims 9 to 12, in the conventional mechanics processing, it is not possible to find realization means for reproducing static friction, kinetic friction and kinetic behavior with velocity variation by only one parameter characteristic. Particularly, in the micro velocity area of the static friction and the kinetic friction, there is negative resistance characteristic in which when lowering the velocity resistance force increases, and the negative characteristic diverges, therefore, it is difficult to calculate the dynamic behavior. The present invention is one resolving method in which the dynamic behavior of this negative non-linear parameter is reproduced. (See, page 92, line 30 to page 98, line 19, Figure 26, and equations 33 to 37.)

With respect to dependent Claims 13 and 14, in the conventional mechanics processing, it is not possible to find realization means for reproducing dynamically mixed behavior while relating angular velocity of a moment of inertia of a rotated body to centrifugal force and moving velocity of translational member coupled to torque with each other.

With respect to independent Claim 15, on the basis of the method of structuring the mechanisms described above with respect to claim 1, further points of distinction from the Samad patent are as follows:

The reference Samad takes, as answered above relative to claim 1, calculation processing procedure depending on the input/output of the outside, because of forward rotation processing of the outside input, the pretreatment means, the non-linear approximation apparatus, the after-treatment means and the outside output (there is no disclosure processing reciprocally in the cited reference). On the contrary, the present invention takes the closed loop system (claim 1) connecting mutually the input/output state quantity and the parameter between the linear model part and the non-linear model part, therefore, it is possible to calculate the linear model part and the non-linear model part repeatedly without reference to the outside input/output (see, page 192, line 19, to page 194, line 27 and Figure 77).

With respect to dependent Claim 16, the Samad patent discloses, as pointed out above with respect to claims 1 and 2, forward rotation processing of the outside input, the

W661616.1

Docket No. 3411-4
Application No. 09/551,867
Page 27 of 29

pretreatment means, the non-linear approximation apparatus, the after-treatment means and the outside output. The present invention provides the closed loop system connecting mutually the input/output state quantity and the parameter between the linear model part and the non-linear model part (claims 1 and 15).

Dependent Claims 17 recites similar distinctions as those pointed out above for claim 5 and thus is allowable over the Samad patent.

Claim 18 relates to processing of an electrical non-linear characteristic reproducing apparatus, so claim 18 does not relate to the mechanical processing. Further, it is not possible to find, in the mechanical processing, means for reproducing dynamic behavior of the components having negative characteristics in which when increasing voltage, current decreases. Furthermore, there is no disclosure of means for processing the negative characteristics also in the Samad patent. The present invention realizes means for reproducing dynamic behavior of the components having negative characteristics with the processing method in which conventional mechanical processing is improved, that is described in the answer to the reason of rejection under 35 U.S.C. §103 for claim 5.

Independent Claim 19 recites similar distinctions pointed out above with respect to claim 1 that are not taught or suggested in the Samad patent.

With respect to dependent Claim 20, the Samad patent does not disclose the feature claimed in claims 19, 20 of the present invention. The reference Samad is not provided with a state quantity selecting unit for performing transformation or connection of the input/output state quantity, and a logical decision unit determining necessary logical value for transformation or connection while utilizing the input/output state quantity of the state quantity selecting unit, wherein a relation between the input state quantity and the output state quantity is changed over to a connection relation according to the logical value determined by the logical decision unit.

With respect to dependent Claim 23, as described above with respect to claim 5, the present invention, different from the conventional mechanical processing, employs dynamic equation in which the velocity balance equation is mixed to the force balance equation, therefore, it is possible to calculate coupled state (relative movement possible state) and separated state (relative movement impossible state) in connection with the force and velocity, or the angular velocity and torque between the two members.

Independent Claim 27 recites similar distinctions as pointed out above for claim 1,

W661616.1

Docket No. 3411-4
Application No. 09/551,867
Page 28 of 29

which are not taught or suggested by the Samad patent.

With respect to dependent Claim 28, in addition to these distinctions, the Smad patent discloses the state variate, the decision state quantity and the state estimation, and its decision method necessary for the optimization of the neural network, however, the reference Samad does not disclose the method for obtaining deviation on decision value being varied in accordance with positive or negative of the state quantity variation width (see, page 171, line 4 to page 172, line 12, and Figures 65 to 67).

Independent Claims 33 to 36 each recite similar distinctions as pointed out above for claim 1. As such, these claims are considered patentable.

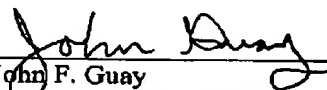
The remaining claims are patentable by virtue of their dependence from one of the allowable independent claims discussed above, and further for the additional features recited.

W661516.1

Docket No. 3411-4
Application No. 09/551,867
Page 29 of 29

All rejections raised in the Office Action having been addressed, it is respectfully submitted that the present application is in condition for allowance and notice of allowance is earnestly solicited.

Respectfully submitted,



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W661616.1